Final Research Grant Report to

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Title: International Research Workshop on Integrating GIS and Environmental Modeling: Problems, Prospects, and research Needs.

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Report

Subject: The 4th International Conference on Integrating GIS and Environmental Modeling (GIS/EM4) was convened in Banff, Canada, September 2-8, 2000 at The Banff Centre for Conferences. The meeting's purpose, like it's predecessors was to reformulate, each three to four years, the collaborative research agenda for integrating spatio-temporal analysis with environmental simulation modeling.

Attendance: Approximately 400 persons attended the Banff meeting. This number consisted primarily of scientists from all disciplines but also included technologists and decision makers. As planned, attendance numbers declined slightly from previous meetings as a consequence of selecting the first venue outside of the United States and expanding the scope of the meeting to directly integrate the social and policy sciences. This tradeoff of absolute numbers for a more international and inclusive meeting was a planned one that will also guide future meetings. Numbers are expected to rise as we transition to a slightly different and more dispersed international scientific community.

Publications: Special issues of the Journal of Environmental Management and (the journal) Transactions in GIS were prepared in advance and delivered to delegates at the conference. Many of the leading papers contributed to GIS/EM4 have been peer-reviewed and selected for inclusion in these journals. A digital proceedings in CD-ROM format is in final editorial stages and will include contributed papers, presentations, and posters from the meeting. In addition, a special thematic book of invited chapters is nearing completion as a parallel project to complement the 4th conference. This volume titled *GIS and Environmental Modeling* will be published by Prentice Hall, also in early 2001. Both of these publications are

expected to be completed to high production standards within acceptable schedules.

Funding: Minimum funding required to supplement revenue from attendee registrations was estimated at the level of about $35,000. This minimum funding level would not have offset costs of operations otherwise incurred as in-kind support at our University of Colorado-CIRES Conference Secretariat. Strong and persistent co-funding efforts by the Director allowed this funding level to be exceeded by nearly three times. Additional funding was used to purchase staff time for the conference director and support personnel for accounting, data base management, computer programming, and operations assistance. Base funds met costs of deposits and purchased on-site planning, logistical, and operations support. Sufficient revenues were generated by the conference to offset nearly all costs of pre- and post-conference publishing.

Education: Special NSF funding to the conference provided Graduate Student Fellowships to five (primary) winners of a competition in which the best student-authored papers were judged by a panel of scientists drawn from the conference's Core Planning Group. Winners were awarded fellowships in the form of waiver or payment of most costs of attending and presenting their papers at the meeting. As a complement to these fellowships, other funds provided registration fee waivers to seven "honorable mention" student winners of the same competition. This was necessitated by the larger-than-expected number of high quality student papers submitted. Nearly fifty students proposed papers and posters to the meeting and nearly that number chose to compete in the fellowship competition.

Involvement: It was hoped that significant involvement of other (non-GIS) model development communities would be achieved to balance exposure to the GIS tool development community. Good success in this regard was achieved via the organization of opening tutorials and special workshops that included many developers of integrated modeling frameworks with a scope broader than a conventional GIS software development trajectory. Despite strong effort by the secretariat, more limited success was achieved in the exhibit portion of the meeting which offered hands-on experience with more model-specific tools. Unfortunately, very long planning horizons among such developers, and competing modeling and budgetary considerations for some of them, constrained the ability of some to participate. However, due to our concerted effort and significant progress made on this front, future meetings will be able to expand fully into this area and to draw fully on developers and users relying on modeling tools that complement existing GIS functionality. As an interim measure, solutions were devised to creatively use the web to provide remote exposure of more participants to a broader range of tools by developers who could not participate on-site.

Innovation: Good success has been enjoyed in incorporating human-environment interactions and the social/policy sciences in both the group of scientists advising the conference and those contributing to special workshops and keynotes. An important innovation in this regard involved the cross-indexing of all written contributions to the meeting to reorganize the meeting's typical structure into a program that actively bridged disciplinary domains and provoked fresh thought about what the meeting should enunciate in a proposed agenda for future research. This technique caused participants to follow their interests in unconventional

ways and thus, to become exposed to relevant but unexpected work by other-disciplinary colleagues. A risky and laborious approach, this effort was judged a success by participants who confirmed the meeting had again operated as an idea generator and importantly unconventional learning environment. Other innovations included student and model developer involvement as described above. Our only set-back in this regard was the sudden and unpredictable loss of an opening keynote speaker to a compulsory southern hemispheric meeting, but a suitable substitution was made.

Reporting

In addition to this report and the publications already described, a more complete analysis of the 4th conference is in progress. It will include results and recommendations of work groups designated to examine key issues and relationships and to contribute their conclusions to a revised agenda for research on integrating GIS and environmental modeling. A parallel analysis is also being made at the ten year anniversary of these meetings to place the 4th meeting into a broader context with the preceding three meetings and to provide status and trends information useful to plan for the next decade and the start of a new century. It is expected that the outcomes of both of these efforts will be integrated and made available in a white paper which will be provided later to all contributors and sponsors, and to key scientific agencies. A copy of the CD-ROM proceedings publication and announcements of related publications, will be forwarded to contributors, when available, as a follow-up to this report. The conference web site which will be made an on-going one, will soon be adapted to create a continuous link between colleagues and a bridge between these periodic meetings.